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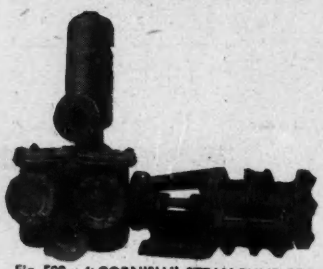

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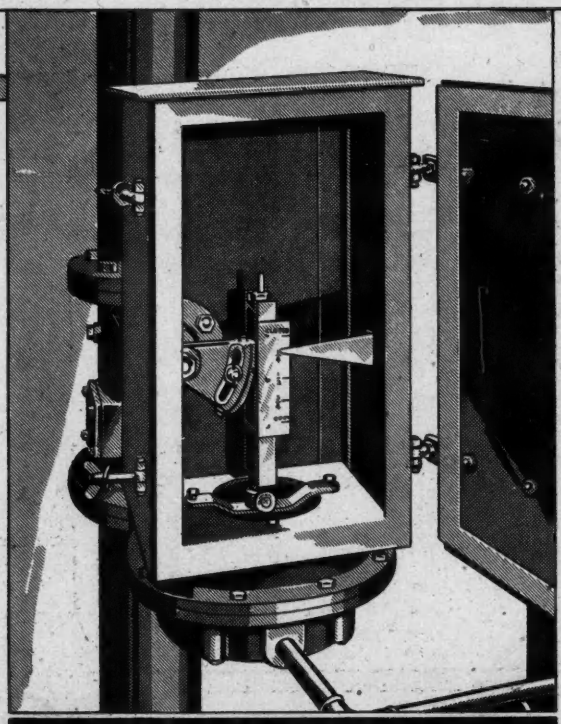

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GAS JOURNAL, FEB. 24, 1943

VOL. 241 95th YEAR No. 4162

EDITORIAL NOTES

NO FUEL RATIONING

THE Minister of Fuel and Power was in optimistic mood last week when he spoke of coal production and coal consumption. Last June, it will be recalled, the gap between the two was in the neighbourhood of 12,000,000 tons. Now he said, in the absence of any unforeseen occurrence the gap will be closed by the efforts of both consumers—housewives, managers, stokers—and producers, the colliers themselves. Major Lloyd George referred to the "fireside front," and the target figure of 4,000,000, at which domestic consumers were urged to aim. Week by week, in nearly every home in the country, substantial savings have been made, and the target has nearly been reached. Of course, we must be thankful for the mildness of the winter, but results have justified his belief in voluntary rationing. It is not his intention, therefore, to change over from voluntary to compulsory rationing, but he emphasized that there must be no relaxation of effort. Regarding industrial consumers, he remarked that these had for the most part done well, but there has been disparity in the achievements made. He is satisfied that a great deal more can be done by industrial users, and he expressed his intention of "putting more pressure" on industry from now on, emphasizing that war work, however urgent, cannot be an excuse for wasting fuel. Concerning production, he said that the extra output he asked for last September would not only be forthcoming, but would be very considerably exceeded.

The Fuel Efficiency Committee have done excellent work. Naturally attention has been devoted primarily to those plants known to be working at low efficiency and which offer scope for relatively large saving in fuel, but there are many instances of savings being effected by simple means in plants which would definitely be classed as efficient, which, indeed, have been held up as examples. An excellent instance of gas savings effected by a single firm is offered by a large glass manufacturer. Modifications were carried out on the various plants in their gas-fired finishing processes involving closer adjustment of the position and angle of burners and the resulting elimination of certain other burners. Alterations were also made in the gas ports to save compressed air. These with other modifications of quite a minor nature resulted in a reduction in gas consumption from 12,600 cu.ft. to 3,900 cu.ft. an hour. Then the various training schemes which have been arranged seem to us to open up a field for future general training by stressing the immense scope of fuel technology, not only by arousing interest in the subject, but also in bringing to the fore those best qualified to instruct, and by collecting and collating the best available information on the subject in readily accessible and digestible form. Much is certain to emerge from the activities of the Consultative Committee of the Directorate of Gas Supply and of the Regional Gas Advisory Boards in the direction of fuel economy in gas manufacture; and on the utilization side the Industrial Gas Centres have co-operated with the Ministry of Fuel's Regional Committees in providing a technical service readily available to every gas consumer. Again, there is the Fuel Efficiency Committee set up by the British Hard Coke Association, in collaboration with the Ministry, to examine the amount of fuel used for heating coke ovens, and the general questions of the efficiency of steam raising and fuel economy at coking plants. The Committee is representative of the Coke Oven Managers' Association, together with technicians drawn from the various regions in which the Industry is located.

The industrial fuel efficiency campaign has, of course, been directed largely to alleviating present fuel supply difficulties, but we feel that much has been done which will have a long-term beneficial effect on industrial practice, and which should be of immense value in the post-war years. Conservation of the nation's fuel resources will be a major problem after the war. Also, the probability of high fuel prices will mean that efficient utilization will be of prime importance to industry if manufacturing costs are to be kept within reasonable limits. The present activities, in the words of one industrial association, "have had the effect of making the whole trade fuel-conscious, and this in itself has greatly improved the economic use of coal." It is hoped that this momentum, gained under the exacting conditions of war, will not slacken or lose way when peace returns. As a nation, we cannot afford to revert to the fuel waste of the improvident years before the war.

FUEL USAGE INDEX

AS we went to press with last week's issue of the "JOURNAL" we received a letter from Mr. Arthur Valon which we were glad to publish (*ante*, p. 212). The letter was concerned with the "fuel usage index"—a matter which we discussed at some length in our issue of Jan. 13, when we endeavoured to clarify its *raison d'être* and to emphasize its purpose and importance. While recognizing the importance of the therms lost in the process of carbonization, Mr. Valon expressed the hope that it will not be lightly assumed that the "fuel usage index" is also a complete index of efficiency. In fact we have not suggested that it should be regarded as a complete index of the nature, but we do consider that it is a useful approximate indication of good gasmaking practice, and stands to serve as a guide to progress and as throwing considerable light on weak spots in the Gas Industry, and as showing in some measure at any rate where advances could be and should be made. We have mentioned that the national fuel usage index (which is the complement of the thermal efficiency of carbonization) works out at a figure of 26. But the fuel usage index for different undertakings varies considerably from the national figure of 26. The discrepancies are indeed great, as has been pointed out on several occasions in the past few weeks by Dr. E. W. Smith, Director-General of Gas Supply, and in the interests of the Industry as a whole they undoubtedly call for thought and action. We cannot afford to waste fuel in the process of gas manufacture, and there is evidence in plenty that there is no need for waste which may unwittingly be taking place, and that the Industry has it in its power to become unassailably *the* agency of fuel conservation to the benefit of the State and of the individual.

Mr. Valon, whose opinions we have always respected, went on to remark: "Despite your belittling reference to minor products from coal tar, you do not, presumably, mean to suggest that the value of tar can be fairly assessed according to the therms contained in it, or that the value of therms in gas and coke are identical. Yet this is how they are treated in the 'fuel index'." Therms in gas and coke are not "identical" in their service value, of course, and the value of tar cannot be fairly assessed on its thermal content. But this does not to our mind invalidate the usefulness of the "fuel usage index." Nor had we in mind to belittle in any way the products derived from tar. We premised our comments ("JOURNAL" of Jan. 13, p. 51) thus: "We would like it to be understood and accepted that as a background of what we have to say is our firm conviction that it is needful to have an atmosphere free from smoke, *and that it is*

essential to recover the products which coal can yield on carbonization." Those products naturally include tar and its derivatives. But we felt and still feel that it is most desirable that we should not be too self-congratulatory because the Industry's process has such inherent and undeniable virtues, such intrinsic merit, but should, with a new approach to the interpretation of the process of gasmaking, seek to improve its thermal efficiency by reducing the amount of fuel used in it. We felt and still feel that in past years we may in all good faith have been apt to become too complacent in reiterating the high figure for the efficiency of carbonization and in neglecting steps to improve upon this figure. The main purport of our note was to focus attention on this aspect, and we can hardly perceive any fundamental disagreement between Mr. Valon's comments and our own.

LEEDS UNIVERSITY

THE Report by the Livesey Professor, Dr. D. T. A. Townend, on the work of the Fuel Department at Leeds University during 1941–42 is a record of substantial and healthy progress under conditions of war. Naturally there have been demands on the Department's resources in aid of the general fuel economy effort—demands of various kinds which have been met promptly. There is a heavy increase of entrants to the Department, and in spite of war conditions four new undergraduate scholarships have been provided, two by Mr. Charles Brotherton, and two by the United Kingdom Gas Corporation. Then there has been a generous gift from the national bodies of the Gas Industry, which has enabled the Department to meet part of the immediate needs for equipment and accommodation, though general needs remain to be met. Having in mind current difficulties, one can only regard the progress as eminently satisfactory. A degree course in Chemical Engineering has been instituted, and it seems to us that the effects of the present war have been not to disintegrate or lessen the activities of the Department, but to intensify and consolidate the whole of its work and, we think, render the Department more attractive to youth and its effectiveness in the fuel industries—not least the Gas Industry—more pronounced. We feel sure that this growth and consolidation will stand the fuel industries and the nation in good stead after the war. The foundations have been well designed and truly laid. We ought to be assured in better times of a fitting superstructure.

Personal

On Feb. 13 Alderman GEORGE CLARK, J.P., completed 50 years' service with the Bryan Donkin Company, Chesterfield. About 200 of the official staff attended a meeting at which Mr. A. G. Webb (Director and Secretary) presided, Mr. C. W. Crawshaw (London Manager) conveyed congratulations, and Mr. Percy Hopkinson made a presentation to Alderman Clark, on behalf of the staff, of a wallet of Treasury notes and a handsomely prepared brochure. Alderman Clark, in returning thanks, handed the Treasury notes for presentation to the Chesterfield Royal Hospital. On Feb. 15, at a Board meeting, Mr. D. M. Henshaw, a Director of the Company, and Governing Director of W. C. Holmes & Co., Ltd., Huddersfield, presented Alderman Clark with an illuminated address and a tablet recording Alderman Clark's association with the Donkin Companies.

* * *

Obituary

The death has occurred of Mr. ROBERT S. TAYLOR, Manager of the Haddington Gas Company, who formerly held a similar appointment at Aberlady. He was a Past-President of the Waverley Association of Gas Managers.

Dividends

Croydon.—At the following rates per cent. per annum, less income tax: Preference Stock, 4 ; Maximum Dividend Stock, 5; Sliding Scale Stock, 6.

Grantham.—Final dividend of 5½%, less tax.

South Metropolitan.—On the Preference Stock, 4%; on the 6% Preference Stock, 6%; on the Ordinary Stock, 1%—all for the year ended Dec. 31, 1942.

Stamford.—Interim dividend of £6%, less tax. Final dividend of £7%, less tax.

Letter to the Editor

The Industry and the Contractor

DEAR SIR,—In the discussion upon Mr. Birks' Paper to the Southern Association, speakers commented favourably upon the closer co-ordination between the Gas Industry and the contracting side, engendered by the Gas-Works Safety Rules Committee.

Anything which makes for better liaison between the Industry and those privileged to supply its needs in plant, &c., is to be commended. I suggest that one direction in which this might be furthered is that District Associations which still refuse some form of membership to representatives of contracting firms should now reconsider this somewhat archaic attitude.

There are, of course, some Gas Associations in which this ban does not operate; and at whose meetings interesting and helpful contributions are not infrequently made by members of contracting firms. To be admitted to a meeting by application or invitation, on the other hand, isn't quite the same thing.

Reserving the obvious right to turn down any applicant deemed unworthy of membership, it would seem a progressive and gracious gesture if District Associations which still bar contractors should at least extend the privilege of associate membership to approved applicants whose business is principally concerned with the needs of the Industry.

In the somewhat terrifying picture which is being painted under the title "Post-war Planning," I like to think that the Gas Industry may have its due place in the sun; and that nearby the "contracting bloke" may be depicted as the faithful servant of the master.

Yours faithfully,

Feb. 19, 1943. "ARDEM."

Institution of Gas Engineers

The Council of The Institution of Gas Engineers met in London on Feb. 9, and the following were some of the matters dealt with:

The death was reported of Mr. Stephen Lacey, B.Sc. (London), President in 1936–37, and Dr. F. S. Sinnatt, C.B., M.B.E., F.R.S. (London), Director of Fuel Research, an Honorary Member of the Institution.

A report was made of the work of the Gas-Works Safety Rules Committee, and a Note on an inexpensive method of keeping the tanks of small gasholders free from ice was approved for circulation to small gas undertakings. A recommendation for the extension of the terms of reference of the Gas-Works Safety Rules Committee was also approved. A report was also made of recent meetings of the Gas Installations Committee, the Liquor Effluents and Ammonia Committee, and the reconstituted Meters Committee.

A report was made of recent meetings of the Gas Education Committee, the Gas Education Executive Committee, and the Board of Examiners.

A report was made of the progress of the Gas Engineering Advisory Boards set up recently in the Civil Defence Regions. It was evident that there were still a number of points outstanding which required early discussion, and it was accordingly decided to convene a second meeting of the Co-Ordinating Committee of the Advisory Boards (comprising the Chairman and Secretary of each Board) with the General Purposes Committee of the Council of the Institution and the Director of Gas Supply (Dr. E. W. Smith) on Feb. 26.

A report was made by the Acting Director of Research on the current investigations of the Gas Research Board and of the progress of negotiations for the official association of the Board with the Department of Scientific and Industrial Research. It was resolved that a meeting of the Council of the Institution be held at Leeds, and that a visit of members of Council to the University to inspect the work in progress in the Gas Research Laboratories of the Department of Coal Gas and Fuel Industries be arranged for the same day.

Further details of the programme of the 80th Annual General Meeting, which is to be held, circumstances permitting, in London on June 9, were considered and approved.

It was reported that an invitation had been received from the Codes of Practice Committee of the Ministry of Works and Planning to the Institution to act as the convenor body for a Committee to draft Codes of Practice relating to the utilization of gas.

The Programme of Special Courses in the Department of Coal Gas and Fuel Industries, with Metallurgy, at the University of Leeds for the Session 1942–43 was received.

A report was made of the work of the Parliamentary and Scientific Committee, on the Executive Committee of which the Institution is represented.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

Cornish Gas Association

Address by Dr. E. W. Smith

On Jan. 27 Dr. E. W. Smith, C.B.E., Director-General of Gas Supply, visited Truro to address Members of the Cornish Gas Association. The President of the Association, Mr. F. G. Kingwell, Manager of the Falmouth Gas Company, was in the Chair, and the majority of members attended, together with a number of directors representing the owners of Cornish gas undertakings.

The **President,** introducing Dr. Smith, who had been invited to address them on the subject of "Post-War Reconstruction of the Gas Industry," extended to him a hearty welcome.

Dr. **Smith,** in the course of his Address, remarked that there had been little new in gas legislation bearing on matters affecting technical practice since the Act of 1920. Certain financial facilities had been afforded by the Acts of 1929, 1932, and 1934, but further consideration was required on these aspects of the problem. In the future it was possible that even greater regard would have to be paid to consumers' interests than in the past. Investors must be fairly treated, but dividends were not the first consideration. The consumer came first and should have the best and cheapest service possible.

The aims of the Industry, he continued, would be to improve service and to cheapen production. In the past there had been much neglect in coke grading and marketing. This should not continue. Every part and phase of the Industry should be developed to its full extent. The price of gas was, of course, important, but good service and constant pressure came first. Pressures should be constant and confined within narrow limits. Among the difficulties which the Industry would have to tackle in future this was the most simple to overcome, and yet had been the most neglected.

There is a place in the national life for both gas and electricity, each in the spheres to which it was best suited. The Gas Industry had started early, and there were instances where gas was being used for work which could be done better by electricity; the reverse condition was also to be found. Concerning coal resources, it was a national crime to export raw coal as they had done in the past. Unlike manufactured commodities, once coal was mined it was not reproduced. It was, in fact, a wasting capital asset—a national asset which might be frittered away unless forethought followed by deeds was exercised. Coal conservation should receive the utmost attention, and carbonization plants be as efficient as science could develop.

He did not think that nationalization of the Industry was desirable or necessary. They could best develop on regional lines. In this regard the holding companies were a good half-way house. Some were doing well in reorganizing the Industry. Some, however, were rather haphazard in their operation. They must have patience, as in any national reorganization they were up against the interests of councils, boards, and even officials, who in some cases were fired with excessive local patriotism. A great deal of planning had already been done, but the fringe of the problem had hardly been touched. With co-operation and understanding they would eventually achieve their aims.

At present undertakings were not always achieving the highest possible efficiency. Under modern processes 74% of the heat units of the coal carbonized was recovered as saleable products, the remaining 26% being lost in the process. Many installations were not getting these results. It was the duty of engineers and managers to look into their carbonization processes to see if more could not be done to get higher efficiency.

In the carbonization of Yorkshire coals in horizontal retorts he advocated the production of 500–550 B.Th.U. gas, this being later diluted by the introduction of producer gas or blue water gas to bring it down to the required C.V. The lower C.V. should not be obtained direct from the carbonizing plant by excessive use of the exhausters.

Again, they should not be content until the sulphur content was reduced to, at most, 8 or 9 grains per 100 cu.ft. It would then be possible to use, with safety and economy, flueless heaters giving maximum efficiency. Proper ventilation of rooms, by a correctly proportioned flue or other means, was, even with low sulphur in the gas, most important.

The question of accountancy was also important, and this matter should be given more attention in future than it had in the past. Important economies could be effected by searching through and analysis of costs of manufacture, distribution, &c. Great economies in the utilization of gas were being achieved, and in this respect the Industrial Gas Centres had done and were doing great work. He knew of instances where certain industrial gas consumers had doubled their output without any increase in gas consumption, solely due to the elimination of waste, and better administration. He was sure that there was a great future for the Gas Industry.

Generally speaking, physical linking of gas undertakings in Cornwall would not appear to be practical; they could best operate economically as individual but co-ordinated units. More attention should be paid to the improvement in remuneration and welfare of the personnel, who were often very poorly paid. They should receive adequate salaries commensurate with their abilities and achievements.

Mr. C. L. Rosewarne moved a vote of thanks to Dr. Smith, which was seconded by **Mr. F. R. G. Grant,** and carried with acclamation.

At a luncheon which followed, the toast of the "Gas Industry" was given by **Mr. W. H. Lane** and responded to by **Mr. F. J. Nettle** and **Dr. Smith.**

Staff Committees

The Gas Light and Coke Company Makes an Experiment

In a Paper presented to the Office Management Association recently, **Mr. Brian Wood,** Secretary, and **Mr. G. T. Basedon,** Divisional Manager, of the Gas Light and Coke Company's Central Division, outlined the principles, scope, and working of the new Staff Committees set up by the Company about a year ago.

These Committees, Mr. Wood said, are the direct outcome of the policy of decentralization and devolution of responsibility of which the Divisional Scheme, launched by Mr. A. E. Sylvester in 1938, was the first and most important step. Under this plan each of these Divisions was, for commercial purposes, placed under its own Divisional Manager, and the Divisional Manager gained direct access to the Management in the person of the Commercial Manager and the Managing Director.

The pyramid of responsibility was designed to enable decisions to be communicated to executive officers quickly and with a minimum of written instruction; and, by the same process in reverse, to aim at decisions in full consultation with those officers.

It was felt that in addition to this pyramid of managerial and executive staff there should be facilities for management officers to meet representatives of workmen and non-executive staff. This would enable the broad lines of policy to be made known to workmen and non-executive staff, and give them an opportunity to comment on the running of the business and on how such running affected them as employees.

For the workmen the Works Committees were already in existence, and at their meetings members have been encouraged to express themselves freely. But there was no ready-made channel through which the Management could make known its policy to the staff of office workers, technical officers, and outdoor representatives, or through which the staff could express views on matters concerning them. It was to create such a channel that Mr. Sylvester, then General Manager, now a Managing Director, decided early last year that Staff Committees should be set up.

The first months were exploratory and no set constitution was attempted. Each head of Department was left to set up his own Committee, in consultation with his staff. There was to be no limit to the scope of subjects that might be discussed except that personalities might not be mentioned.

On the whole the staff may be said to have reacted favourably to the idea, although in most Departments the atmosphere was at first strained and a watchful attitude was maintained. Now that experience has been gained the staff seem to understand the motive underlying the movement and are taking a lively interest in it. They appreciate being given news of topical interest and being told how their particular Department fits in with others, and how they are linked to the General Management of the business.

The following points, taken from the records of one of the Committees, are typical of questions raised throughout the Company:

(1) Ought not war bonuses to be paid to employees in Services in addition to National Service Allowance?
(2) Price of lunch in staff canteens.
(3) Widows' pensions.
(4) Will employees in Services suffer in salary or position when they return from the Services?
(5) A protest against the method of cancelling third week's holiday.

It is not perhaps surprising to find that by far the greater part of the matters discussed are matters connected with welfare, and comparatively few contain observations on the running of the business as it affects the outside world. This is very largely due, Mr. Wood suggested, to the fact that the opportunity for ventilating views on welfare matters just did not exist before Staff Committees provided the outlet. There are matters which a member of the staff would be prepared to raise through an elected spokesman which he would feel disinclined to mention to his chief as a personal matter.

One or more special meetings have been called by the Management. These have been to announce and amplify decisions which it was felt could best be done by word of mouth instead of relying, as previously, on the more formal printed circular, which in the past has not always been well understood. For example, Staff Committees were summoned when it had been decided to extend the official working hours.

Mr. Wood concluded the Paper by saying that experience so far supports the conviction that the Staff Committee meets a need. Corporations like the Gas Light and Coke Company have a social duty to their employees, as well as to the community these employees serve. Service to the community will be the better if it is given by a staff who have a real sense of responsibility towards their fellow men. The Staff Committee, the Company feels, will help in fostering that sense of responsibility.

Administration and Accounting Practice

The following is a report of the discussion on the Paper by Mr. P. Knowles, of the United Kingdom Gas Corporation, Ltd., to the Manchester and District Junior Gas Association—see "JOURNAL" of Feb. 10, p. 189.

The **President** said that Mr. Knowles had given the members the benefit of his experience, which would be of great value to prospective gas managers and engineers. The data contained in the Paper were extremely useful.

Mr. **J. Castle** (Leyland) said it was vital that such subjects should be studied, for it often happened that a man who was a successful engineer found himself at a loss in regard to financial control and commercial administration when appointed to an executive position.

Mr. **F. Johnston** (Manchester) said that it was important that a correct allocation of expenditure should be made as between capital and revenue, otherwise correct trading results would not be obtained. While it might be decided to charge expenditure on new and additional services to revenue, it was a charge against capital, from an academic point of view. He agreed with Mr. Knowles that it was not the cost of a job which decided whether the expenditure should be charged against repairs or renewals, but suggested that the proportion of labour to materials was a deciding factor. If practically no material had been used, then it was maintenance of plant and chargeable against repairs. Alternatively, a high cost of materials with proportionately little labour would probably make the job a charge against renewals. While it would be necessary to take physical stocks of coal, coke, and other residuals at the end of the accounting period, he suggested that physical stocks of other materials and stores could be taken during the accounting period and preferably by an independent stock-taker.

Mr. **Knowles,** replying, said that if expenditure on services and fittings got into capital account it was problematical whether it would ever be written off. Consequently, if a consumer were lost there would be an asset in capital account which was valueless. Under the system outlined in the Paper, any sums realized from recovered materials would be credited to revenue account. The 1912 and 1940 income-tax agreements provided that both renewals and additions of services and fittings should be allowed as a charge for income-tax purposes. It appeared, therefore, that the authorities considered that immediately the services and fittings were fixed they lost their capital value. Expenditure on wages was most probably repairs, but when material was involved consideration must be given as to whether it was repairs or renewals expenditure. The Paper was primarily applicable to small and medium-sized undertakings which, in all probability, would not have a stock-keeper, but, if there were one and it was desirable to relieve pressure at the year end, physical stock could be taken, say, one month before the accounting dates, provided care was taken to adjust the figures for actual ingoings, and outgoings, during the following month, so that at the accounting date the actual stock would be known.

Mr. **E. B. Fields** (Blackburn) stated that prior to the war a municipally-owned undertaking experienced no difficulty in obtaining a grant from the Ministry of Health for expenditure on services. He was rather surprised that Mr. Knowles recommended that every job should be costed. In the undertaking with which he was connected, it had been decided to abandon the practice of costing each job, because the materials had gone through the stores system and the workmen's time had been analyzed so that any particular job could be costed as and when required. In a large undertaking the costing of each individual job would take a great deal of time, and with the present shortage of staff this was to be avoided.

Mr. **Knowles** reminded the members that the Paper was chiefly intended to deal with small and medium-sized undertakings. It would be exceptional for small undertakings to have a stock-keeper and stock records. The fitter would probably be able to obtain such materials as he required, but there would be no check on materials surplus to the job, which, of course, should be returned to the stores. The job cost sheet would provide with the minimum expenditure of labour the necessary basis for a check on materials taken from stores, but not used on the job.

Mr. **F. Bell** (Liverpool) was of the opinion that those who had been trained as engineers were accustomed, especially if serving a large undertaking, to leave questions of accountancy to specialists. Only by digesting the substance of papers such as that presented by Mr. Knowles could members realize the value of costing—sometimes described as a "nuisance value"—and how much it meant in the successful carrying on of an undertaking.

Mr. **W. Hodkinson** (U.K.), replying to questions regarding budgetary control, said that the chief officers of the works connected with his Company were requested to submit estimates for the coming year. These were compared with the accounts for the previous year, and consideration was given to abnormal expenditure by way of excessive renewals or planning expenditure by way of improvements. From this information a plan of campaign was drawn up for the subsequent year.

Mr. **Knowles** added that the estimates were also used to ascertain whether the price of gas should be lowered, or kept at its present level, or whether it would be necessary to submit a case to the Ministry of Fuel and Power for an increase in price.

Mr. **Haslam** (Bolton) pointed out that if the expenditure on additional services was not charged up to capital, then the assets were understated and, in the event of the undertaking being sold, a lower price would be obtained than was justified by the capital expended.

Mr. **Knowles** did not consider the fact that the capital account did not include expenditure on services would affect the purchase price of an undertaking. The prime factor in the acquisition of an undertaking was not its capital expenditure, but the ability to earn sufficient revenue to maintain adequately the works, plant, and apparatus, and also to provide a reasonable return on the capital invested.

Mr. **Race** (Farnworth) emphasized the necessity for taking physical stocks of coal and coke four times a year. He had worked both with and without a costing system and, while job costing was of paramount importance, the question did arise as to whether it could not be bypassed, to a certain extent, under present conditions.

Mr. **E. B. Fields** said his remarks about costing appeared to have been misunderstood. There were undertakings which were continuously fixing thousands of one particular type of heater. The average cost of fixing would consequently be well known and, in such circumstances, it appeared to be unnecessary to take out a costing sheet for every job in order to ascertain the cost.

Mr. **T. Haworth** (Darwen) called attention to the fact that although the Paper was restricted to small and medium-sized undertakings, it could well be applied to larger undertakings. Reference was made to the dividends from a gas undertaking very often forming part of the income of retired and elderly people, but it must not be overlooked that the Gas Industry existed as a public service. If that public service was rendered upon sound economic lines, then the dividends would follow as a matter of course. Good service must be the first consideration.

The **President** said that in municipal and well-managed undertakings new services were charged against capital account. All the services lost during a year could be written off. One instance which might be cited was in regard to slum-clearance schemes when large numbers of buildings were demolished and the services and mains were lost. By capitalizing the expenditure and writing off what was lost, a record of the actual position could be preserved. Every engineer should prepare estimates for the purpose of ascertaining as far as practicable what would be the position at the end of the financial year. It was a great mistake for junior gas engineers to leave financial matters entirely to the chief clerk or the cashier.

Mr. **Fields** proposed a vote of thanks to the Author of the Paper, which was seconded by Mr. **D. Benson.**

Honorary Member

The **President** announced that Sir Frederick J. West, K.B.E., J.P., had accepted the invitation of the Council to become an Honorary Member of the Manchester and District Junior Gas Association.

Rubber Conveyor Belting

The British Standards Institution has just issued a War Emergency Revision of B.S. 490—Rubber Conveyor and Elevator Belting. This Specification is intended to supersede the corresponding British Standard Specification 490/1933 for the duration of the period of emergency caused by the acute rubber shortage resulting from the war.

It was prepared by the Technical Sub-Committee of the India Rubber Manufacturers' Association (now the Technical Committee of the Federation of British Rubber and Allied Manufacturers' Associations) acting as Technical Advisory Committee to the Rubber Controller and the British Standards Institution. The Specification has been based on the proposals of this Committee embodied in Rubber Control Order No. 16 limiting the use of rubber in belting.

Copies of the Specification may be obtained from the Britisth Standards Institution, 28, Victoria Street, S.W. 1, price 2s. 3d. post free.

A Meeting of the Committee of the Gas Companies' Protection Association will be held at the offices of the Association, 5, Victoria Street, S.W. 1, on March 1, at 2.30 p.m.

Meetings of the following Committees of the London and Counties Coke Association will be held on March 15 at Gas Industry House: Finance Committee, 10.45 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m.

Messrs. Ryde, Sons & Browne's address from Feb. 23 is 3, Victoria Street, Westminster, S.W. 1. The telephone number, Whitehall 5261, remains unchanged.

FUEL ECONOMY IN GAS WORKS

No. 5

We are indebted to the Severn Valley Gas Corporation, Ltd., and Gas Consolidation, Ltd., for permission to reprint a series of notes specially compiled for them by G. M. Gill.

FUEL ECONOMY IN THE BOILER HOUSE

THERE are a large number of points to observe in looking after boilers to obtain the best results and to save fuel. Most of the suggestions, as in the previous articles, are of a very elementary character, but it does not do to assume that because they are elementary they are therefore observed in practice, as experience shows that it is only in the best-run plants that virtually all the elementary principles of good operation are observed, while in badly operated plant it is the elementary principles which are not observed.

An inspection of the ash heap is always worth while. It often discloses that waste is proceeding or that the wrong size of fuel is being used. For instance, if the orders are to use breeze only, and the ash heap discloses pieces of coke, it is obvious that the orders are not being observed, and that coke is finding its way or possibly being smuggled into the boiler house. When using breeze there should be no usable fuel left in the ashes.

If, on the other hand, coke of, say, 1½ in. and upwards is used as normal practice, then it may be worth while to have the ash heap sorted over and good fuel recovered.

It is important to use fuel of approximately the same size at one time. For instance, if breeze be used the fire bed should consist of breeze only, say, ¾ in. to dust, and not be mixed with coke of any larger size. The conditions to be observed, particularly in the thickness of the fuel bed, vary considerably according to the size of fuel being used.

The Author considers at this stage that he cannot do better than reproduce the instructions which were issued to boiler stokers working on coke-fired Lancashire and Cornish boilers in the East End of London at a time many years ago when numerous steam users were converted from coal to coke, at which time he was closely concerned in demonstrating the advantages of coke over coal.

These directions were as follows, and were posted up in the boiler houses of the factories converted to coke:

1. Being a non-volatile fuel, coke must be fired on a different principle to bituminous coal.

2. The fuel should be fired to maintain an even thickness from door to bridge.

3. The thickness of the bed of fuel must depend on the size of coke, and should be approximately as follows:

When using large coke, say, 3-in. cubes, the fuel bed should be about 10 in. thick.

When using smaller coke, say, 2-in. cubes, the fuel bed should be about 8 in. thick.

When using broken coke, say, 1½-in. cubes, the fuel bed should be about 6 in. thick.

When using forge coke, say, ¾-in. cubes, the fuel bed should be about 4 in. thick.

4. A coke fire of the right thickness, when burning freely and correctly, should have the appearance of being of a red and yellow colour on top. If much blue flame is visible, the thickness is too great; while if it is of a distinct yellow colour, the fire is too thin.

5. All the air required for combustion should be admitted underneath and through the firebars. No air should be admitted through the doors, or through any smoke-consuming appliance at the back of the bridge.

6. Coke requires plenty of draught—more so than coal; so that it is advisable to make a special examination for air leaks between the brickwork and boiler at various points, through the damper opening, and through badly fitting portions of the fire doors. Any cracks in the brickwork should be filled in. An examination of this kind will frequently make all the difference between success and failure in burning coke.

7. A coke fire does not require poking or stirring up. It should be left to burn without any attention of this kind, the only exception being that at intervals a slice should be passed between the fuel and the firebars, to break up clinker as it forms, so as to prevent it from adhering to the bars and from checking the admission of air.

8. The tools in use should be kept properly sharpened. In burning coke this is of more importance than when burning coal.

9. The intervals at which a coke fire should be cleaned will depend upon the ash in the particular coke being burnt and the rapidity with which the coke is consumed. This will vary widely—say, from 3 to 8 hours, according to circumstances.

10. In cleaning a coke fire the same method should be followed as when cleaning a coal fire; but it is of the greatest importance that as little as possible of good coke should be drawn out with the clinker and ashes. Unless great care is exercised, it will be found that after the fire is cleaned there is insufficient hot coke to ignite the fresh fuel. (This is a common fault with stokers who are inexperienced in coke stoking.)

11. With a Lancashire boiler, when the load is on, a fair interval should be allowed between the cleaning times of the two furnaces, as it must be recognized that coke, like anthracite, being a non-volatile fuel, takes more time than bituminous coal to ignite and burn freely. When the load is on, it is advisable to clean at a time only one half of the furnace.

12. It is unnecessary to use any coal at any time except when lighting-up a boiler from cold.

13. Fires may be banked-up quite satisfactorily with coke.

It will be observed that the above directions compare the burning of coke with that of coal, whereas in gas-works few, if any, works use coal, and therefore it may be said that no reference need be made to the burning of coal. Actually, however, this matter is well worth special mention, as many boiler stokers in gas-works have been originally trained to burn coal, and they persist in adopting the same methods when burning coke or breeze.

To a large extent the above directions prepared for burning coke from ¾ in. and upwards apply also to burning coke breeze from ¾ in. to dust, commonly used in gas-works.

Breeze should certainly not be fired in a layer thicker than 4 in., and the layer as in coke should be of an even thickness from door to bridge.

It might here be pointed out that to obtain the maximum output of steam, the best size of coke is about 1 in. cube. This can be burnt efficiently to generate from 25% to 30% more steam than large coke.

In the case of vertical boilers it is advisable to use large coke, as these have usually been designed to use coal or coke of this size. With vertical boilers, the space between grate and heating surface is usually considerable, and it is therefore necessary to fill this space to enable the radiant heat from the coke bed to exert its full influence on the heating surface. Thus broken coke or, worse still, breeze, would not produce nearly so good a result with boilers of this type as large unbroken coke.

With coal it is, of course, the flame and radiation from the glowing bed of fuel, and with coke the radiant heat from the solid fuel which gives its heat to the water surface of the boiler.

Proper Combustion

It is important to have chemical analyses made of the waste gases leaving the boilers. Without these it is impossible to know that proper practice is being observed. It is just as bad to be using too much air for combustion as it is to be using too little. In the first case you are cooling down the heating surface with excess air, while in the second the fuel is not being thoroughly burnt and consequently heat units are passing up the chimney.

An Orsat testing apparatus will soon disclose whether the waste gases have a reasonable composition. Thus, with Lancashire and Cornish boilers, used in so many gas-works, a satisfactory result will be: 12% CO_2, with upwards of 14% with very good operation. A figure of less than 12% calls for attention.

The various instruments recommended for use in obtaining good results from boiler plant are as follows: Draught indicator, CO_2 recorder, indicating pyrometer, steam pressure recorder, water meter, steam meter, and an Orsat gas analysis apparatus, to which reference is made above.

The proper use of these instruments does not necessarily call for the service of a chemist, as qualified technical assistants can do all that is necessary, but the Author would strongly advise that the boiler plant should come under the close scrutiny of the chemist as the best man to do this kind of work.

Radiation Losses

Cracks and badly maintained brickwork should have attention and be well repaired and pointed up. Air infiltration is a very bad thing and brings about much loss, often also reducing the chimney draught materially. Badly lagged boilers and steam pipes are a fruitful source of loss. It is essential to give attention to these. Similarly, the steam leaks from boilers, from safety valves, from blow-down cocks, from steam pipe joints, and glands throughout the works, should be repaired and then kept in good condition.

Apart from these losses, those due to badly softened water and the resultant scale in the boilers are often substantial. Attention to water softening is most important. In small plants it may be that there is no water-softening plant, in which case it is highly desirable to get the best advice and to use regularly the most suitable boiler fluid for the particular water in use. Some of the best suppliers of such fluid give good advice as to satisfactory treatment and, further, make regular visits of inspection. It is very bad practice to continue to

use hard water without a suitable boiler fluid, or better still, softening the water properly.

Forced draught by steam jets can be effective, but can also be most wasteful should these be worn or in bad condition. Not long ago an investigation was being made into the steam consumption by all steam-using units in one of the works with which the Author is concerned. The steam used by each engine and pump was metered, as was also the steam used by the steam jets on the boiler itself. It was found that these jets were using half the entire steam generated by the boiler in use. This was speedily corrected and a great saving made.

At another works the boiler fuel consumption was considered to be very heavy; it was therefore decided to make a complete investigation of the steam consumption of every steam-using unit separately and to compare the total with the quantity of steam being generated. A recording steam meter was used to obtain all the necessary data, and by this means the total steam generated was fairly closely accounted for. This investigation disclosed that there were a few steam eaters and a number of small losses using sufficient to account for the very high consumption of fuel. These were speedily replaced or overhauled, with the result that a reduction of nearly 30% was made in the boiler fuel.

For an investigation of this kind a recording steam meter is, of course, essential. Such an instrument can be an excellent investment.

The use of steam injectors for feeding the boiler should be condemned as being most wasteful and inefficient. A proper feed pump is essential. Similarly, steam injectors should only be used for short periods and exceptional use.

Water leaks on boiler settings should always be remedied at once.

An essential investment for all but the smallest works is a steam pressure recorder. The management should always have knowledge of the steam pressure both day and night. Few faults have greater effect on gas-works results than a low or varying steam pressure. This affects among other things the working of the exhausters, if steam driven, which is always serious, as this in turn affects the gas-making results. The Author has always considered that the hallmark of a well run works is a steady and sufficient steam pressure at all times. The effect of bad efficiency in this department is much greater than would at first be appreciated. If your steam pressure is variable and at times insufficient, try the effect of concentrating on this fault and correcting it.

Collection and Use of Exhaust Steam

There are a number of ways in which exhaust steam can be used profitably. Almost anything is better than to have a works where numbers of pipes can be seen blowing out exhaust steam. No good manager will be content to allow this to continue indefinitely.

Among other methods which can be employed is the collection of the exhaust steam into one pipe which delivers the steam to an oil separator, after which it is bubbled directly into the water in the boiler feed water tank. This can conveniently be an old boiler tank adjacent to the boiler plant. This method keeps the feed water as hot as it can be pumped by the boiler feed pump. Provision should be made for blowing away any excess steam through a safety valve set to the required pressure.

In addition there may be sufficient exhaust steam to be used for heating the buildings on the works and so cut out a considerable consumption of coal, coke, and gas previously used for this purpose. Recently, the Author visited a works where all the exhaust steam has just been collected into a common pipe, which now heats the offices, stores, men's lobby, &c. It is resulting in an excellent saving of gas and coke.

PROXIMATE ANALYSIS OF COAL*

By JOSEPH BROWN, M.Sc., and ALAN S. BEAN, M.A.

IN the halcyon days of peace we had the pleasure to present to the Institute a Paper entitled "The Fundamental Principles and Value of Fuel Testing," which dealt broadly with fuel testing as a whole but very intimately with the sampling of coal. At that time we brought forward nothing new and, indeed, scarcely anything not already well known, but attempted only to review the coal-testing situation as a whole, or rather so far as our experience carried us. These remarks hold good for this Paper also, and we again stress that we shall bring forward scarcely anything that is not already well known to you as individuals, but hope that the rather wide field over which our efforts are spread, and the rather large scale on which we have to work, may have given us a viewpoint and a perspective that will be of interest to all, each according to his taste and experience. We point this out particularly because many widely parted schools of coal technology have been thrust together by the war, not only in having to test the products of the other fellow's coalfields, but sometimes to use them.

What is a Proximate Analysis?

This curious expression, *Proximate Analysis*, has a unique meaning, requiring much contemplation and experience in its use before a thorough comprehension of what it implies is gained. The dictionaries give no help, for there you will find "proximate" is derived from the Low Latin "proximat," and is held by the best authorities to mean "next" or "near." Nor is it an abbreviated or bastard version of "approximate," since the proximate analysis is far from being approximate, either in the sense that the results are approximate only, or in the sense that it gives an approximate idea of the composition of the coal; for it is carried out with at least the average accuracy attainable by the analyst in his daily work, and tells us only those things that are found *after the coal has been destroyed* by heating or burning. Indeed the exact composition of coal remains as great a mystery as ever, but a formidable and growing list of known ingredients already exists, and is available as a guide to those with the interest and the months of time required to make an *approximate* analysis.

There are three properties of coal which are evident to anyone who has taken the trouble to observe its behaviour when heated or burned.

The first property is observed in the early stages of heating when yellow-green fumes are seen to escape from the coal but do not readily ignite. These are followed by further fumes that burn merrily with a bright but usually smoky flame, the softened coal meanwhile oozing sticky, black tar. We have watched volatile matter leave the coal. When this stage is complete there remains as a rule a grey to black residue of brittle cinders or coke that burns on with a clear, lambent, blue flame glowing redly the while. This gives the second property—that of leaving a residue of cinders or coke.

Obviously coal can, by the simple agency of heat, be converted into what our predecessors the Alchemists would have duly noted to be a "Foule, Stynkynge, Sulphureous, Volatile Spirit" which is driven off, leaving behind a "fixed" or non-volatile residue. Coke or cinders are very permanent, and their occasional discovery by archaeologists in the midst of historic remains shows that both coal, and this phenomenon, must have been known to man for a very long time. The property was used as early as 1680 for the manufacture of tar "when Becher came to England."

The third easily observed phenomenon is the property of coal to leave behind an earthy, non-combustible residue when it has all burned away. This, of course, is the ash. Its colour will be found to vary considerably—red, yellow, brown, purple, pink, and so forth, some being almost white—according to the coal burned. The amount of this may be easily determined by weighing the residue left after burning a weighed quantity of the coal.

The heating of coal to a red heat in a closed vessel in order to drive off the gross volatile matter and leave behind a residue of coke can, with care, be made into an accurately reproducible quantitative experiment. Thus is provided a test whereby coals may be examined and compared. This simple test soon reveals that coals drawn from different areas differ very considerably in this property. Some of the Welsh coals lose as little as 10%, while other coals lose as much as 40% or more with all shades in between. A good deal of information can also be gleaned by examination of the coke remaining after the completion of the experiment.

There is a fourth property of coal which is not so easily observable as the three properties already mentioned. This is the fact that when apparently dry coal is gently heated at, or slightly above, the boiling point of water, it loses weight without any visible alteration. If left exposed to the air it almost regains this loss of weight. This is almost entirely due to combined or inherent moisture in the coal, and the amount of this loss may be obtained with accuracy. This is the moisture. The loss due to moisture is obviously part of the total loss (due to gross volatile matter) when the coal is strongly heated, or carbonized, as we now call it, and thus the earlier analysts reported a figure which was very correctly described as "volatile matters less moisture." Other misguided operators very inaccurately described the same thing as "volatile hydrocarbons," but since there is no earthly reason to suppose that the "volatile matters less moisture" are composed entirely of hydrocarbons, this expression has, so far as we know, died a natural death. Nowadays the " volatile matters less moisture" is shortened to "volatile matter" or "volatile matters" in the analysts' reports, and in commercial circles is usually tersely expressed as "volatiles."

Now what about the coke remaining after driving off the volatile matter? This we know contains the ash, and when it is burned gives off sulphur fumes, showing that it contains sulphur, so that in itself it must be quite a complex material. In the main, however, it is composed of carbon. So much so that it may be regarded as an impure form of carbon. By deducting from the coke the weight of the ash contained therein one arrives at a figure representing almost pure carbon which is "fixed," inasmuch as it is non-volatile. It has become customary to refer to the figure obtained in this way as "fixed carbon."

The vast majority of methods of utilizing coal either cause it to be

* From a Paper to the Institute of Fuel, Feb. 18.

burned for the sake of its heat energy, or to be heated in closed vessels for the sake of its coke and the gross volatile matters, which are collected in the form of coal gas, coal tar, and ammonia liquor. So we realize that in the absence of more detailed information, earlier generations found they could conveniently analyze and classify their coals by means of a combination of three simple tests that give some idea of the behaviour of the coal when destroyed by heating, an example of which would be:

	%
Moisture	2.0
Ash	8.0
Volatile matter	30.0
Fixed carbon	60.0
	100.0

This is the proximate analysis which, as we have already pointed out, has the virtue of being neither proximate nor approximate, leaving us only to unfold the dreadful secret that some bright genius did, by embezzlement, take the word "proximate," notwithstanding its Low Latin ancestry, and convert it to his own use, to make it mean the results of the experiments described above, when carried out under standard conditions, and reported in the manner we have already shown, so as to make a grand total of 100%.

The three component tests of the proximate analysis and the various methods of carrying them out are fully described in the various British Standard Specifications. Their immediate ancestors were the specifications evolved by the U.S. Bureau of Mines, and the American Society for Testing Materials (A.S.T.M.). The history of the evolution of the methods was given by Fieldner in his Melchett Lecture of October, 1942.* One cannot think of specifications for coal analyses without thinking of Fieldner and his co-workers. Also of Illingworth, whose little classic,† published in 1921, did so much to bring the work of the U.S. Bureau of Mines before the British Coal Trade.

It must be remembered by many of you that up till that time the position of coal testing in Britain was indescribably chaotic. There must have been almost as many different methods in use as there were analysts, and the orderly sanity of the U.S. specifications must have been a joy and a relief to many of them.

We cannot too strongly emphasize the fact that all the three tests of the proximate analysis are purely arbitrary or empirical, and are absolutely dependent upon the strict maintenance of the standard conditions adopted. These remarks include the ash.

In our previous Paper we pointed out that in many disputes the trouble lay *exclusively in the sample*, inasmuch as the coal was later found to have given complete satisfaction in actual use. For this reason we regard the bad sample as Public Enemy No. 1 of the commercial side of the coal trade. Public Enemy No. 2 is the failure, first, to agree on the actual methods of test, and secondly, failure to adhere to these conditions when they have been laid down, whereby different laboratories are unable to agree about the same sample.

These remarks must of necessity apply with equal force not only to individuals or organizations but to national specifications. It is logical and it is certain that loose or vacillating specifications for coal analysis are bound to bring in their train both of the evils mentioned above.

Moisture.—The standard moisture is represented by the loss occurring when the coal is heated for one hour at 105°C. and is a purely arbitrary test. While most of the loss is usually due to loss of combined moisture, there are many coals for which this does not hold. Certain coals contain large amounts of occluded gas, the coal functioning in a manner that may be related to the way the activated carbon in a respirator holds back chemical vapours. The occluded gases vanish along with the moisture when the coal is heated. Tests are provided which take this strictly into account, but for give-and-take commercial practice—as opposed to research—this is hardly necessary so long as both buyer and seller adopt identical methods and stick to them.

Ash.—At first glance it might be supposed that to obtain the amount of ash present in a coal, all one has to do is to burn a weighed quantity and weigh the residue. Alas! it is not quite so simple, since some of the mineral components of the coal behave differently and leave different residues according, not only to the temperature at which the ash is finally heated, but also according to the way the coal is burned. The reasons that cause part of the ash of coal used for boiler furnaces to pass up the chimney stack can also cause the same thing to happen when the ash test is being carried out. Fragments of limestone may be partly or wholly burned to lime, depending on temperature. The colour of the ash should be duly noted.

The Volatile Matter.—This is the king-pin of the proximate analysis, since it is the most difficult to standardize and also incorporates the errors of the moisture test. Whereas the errors of the tests for moisture and ash should amount to only fractions of 1%, even when carelessly performed, small alterations in the conditions of the volatile matter test can cause errors amounting to 3% or more. It is a purely arbitrary test, and quite a number of different procedures for carrying it out have been invented, all of which, under their own carefully controlled conditions, can be made to give identical results when tested against one and the same coal. The necessity to adhere to standard conditions is extremely critical, and the literature of coal science is well spattered with papers giving accounts of battles with the volatile matter.

The process of determining the volatile matter is essentially that of breaking down the coal into coke or other residue, and into volatile matters that are driven off by heat. Since various components of coal are better able to withstand the effects of heat than others, it follows that as the temperature of heating is increased the amount of volatile matter given off will increase. There are subtle variations of this phenomenon, but the general picture is that of increasing volatile matter with increasing temperature. An important factor is the time of heating, for if this is carried on too long the coke within the vessel will commence to burn, giving rise to further unjustified loss. Other factors known to be of importance are the degree of fineness of the coal, the material of the vessel used for the test, the state of the surface of the vessel used, the thickness of the vessel used, the closeness of fit of the lid of the vessel, the amount of moisture in the sample, and the amount of volatile to be driven off. There are workers who claim to have proved the influence of many other factors, including the reading of the barometer and the relative humidity of the atmosphere.

Since the moisture in the air-dried coal varies slightly with the humidity of the laboratory atmosphere, it is important that the moisture and the volatile matter tests should be carried out almost simultaneously. If it is necessary to refer back to a sample for re-test at a later date, the moisture should always be tested as well, since it may have changed very slightly.

Far and away the most important factor in the test for volatile matter is the temperature to which the crucible is heated. Our long experience of both national and international coal testing has shown us that this is the most prominent cause of disagreement between laboratories. In turn we have found that failure to use similar temperatures has arisen from the fact that it has not been instilled into the laboratory workers that they *must use a pyrometer* to control their temperatures. Even to-day we know of several laboratories where the temperature of the volatile test is almost guesswork.

The method worked out by the American Chemical Society in 1898 was standardized in 1913 by the Bureau of Mines and the temperature of heating in the volatile test was fixed at 950°C. ±20°C. This temperature is used at the present time. The American coal analyst has enjoyed a period of 30 years during which, whatever other changes he may have had to make, the tranquillity of his existence has not been disturbed at frequent intervals by totally unnecessary changes in the temperature of his volatile matter test. As the temperature is increased, most of the American coals reach a limiting value, the exception being anthracite. *The same results are achieved with British coals.* Higher heating will yield more volatile matter, but at 950°C. they are in the main practically in equilibrium. Higher heating will have very little effect on the volatile matter. Anthracite is an exception, and there does not seem to be any point at which anthracite is in equilibrium. It follows, we think, that if the volatile matter test is carried out where the coals are far from being in equilibrium, then there will be found great difficulty in obtaining reproducibility in duplicate laboratory tests. It also follows that if the volatile matter test is carried out where the coals are more or less constant in volatile matter, then much of the difficulty in obtaining reproducibility in duplicate tests will vanish. The exception, once again, will be anthracite. We do not, of course, know on what lines the American Committee discusses the volatile matter test in periodical reviews, but we hazard a guess that if ever the Americans change their temperature of the volatile matter test it will be in an upward rather than a downward direction.

It is in connexion with the volatile matter test that we should like to pass a few remarks on British Standard Specifications, particularly the latest—No. 1016.

As Fieldner pointed out, the U.S. Bureau of Mines and the A.S.T.M. have always endeavoured to obtain standardized methods of analysis without, however, freezing them and stopping further progress.

Previous to No. 1016, the British Standard Specifications more than share this excellent qualification. In fact, one could say that in the main, on the analytical side, they excelled, and we thought that, in time, we Britons would wipe out the handicap of having made a start when the other fellow had almost finished. For the volatile matter in particular there was a wide choice of methods, all of which had their own followers and all of which were giving satisfaction to the operators. In a way, they formed a roll of honour to those who had so untiringly worked in the cause of standardization, simplification, or interpretation of the volatile matter.

The centre-piece or standard of standards was the "American" method (*alias* the "crucible method"). By a little laboratory study of the other methods, taken in conjunction with the American or crucible method, it was always possible to achieve an agreement sufficiently good for all technical purposes. In good hands the other available modifications of the volatile test could give more information than is provided by the plain crucible test and were very useful in plant control. There were methods that gave the option of platinum, silica, or porcelain crucibles, and these could be used up to eight at a time if so desired. There were also the Lessing method and the Bone and Silver method. As individuals we have little knowledge of the Bone and Silver method, but we have good reason to believe that the

* *Journal of the Institute of Fuel*, 1942.
† Illingworth, *Analysis of Coal and its By-products.*

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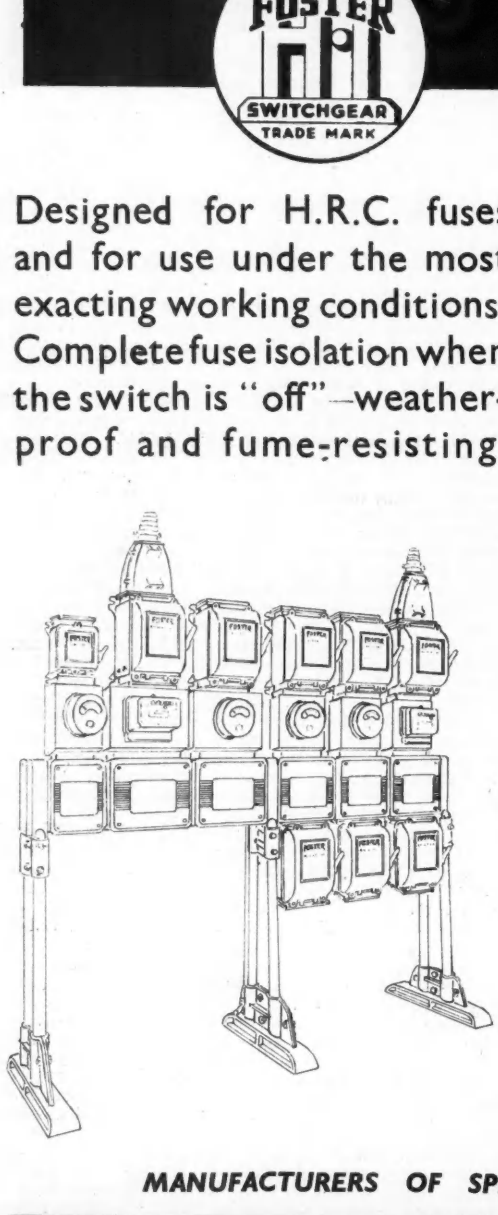

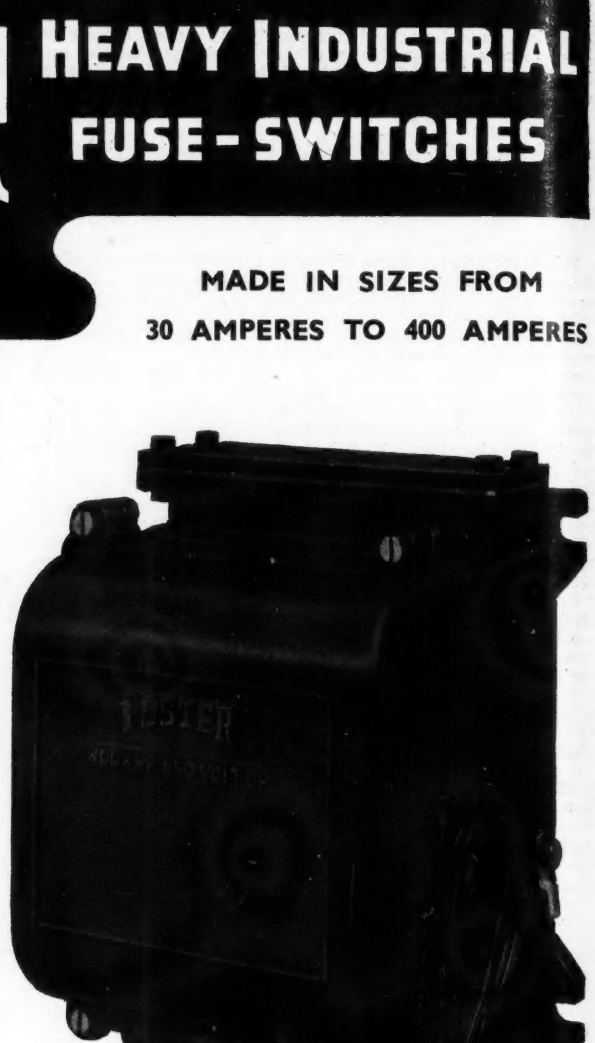

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Lessing method or some modification of it has a future as well as an honourable past.

There was but one small difference between the A.S.T.M. and the B.S.I. versions of the American method for the determination of the volatile matter in coal. The British method called for a temperature of 965°C. ±15°C., while the A.S.T.M. method called for 950°C. ±20°C. In any dispute as to the correct temperature to use, the whole weight of scientific evidence was on our side, although why 965°C. should have been selected when most pyrometers read in 10° intervals we cannot think. In actual practice it matters little whichever of these temperatures be selected, as we shall show, since the coals are at or near the point at which the temperature ceases to play other than an insignificant part.

We had hoped to see the specifications of the B.S.I. and the A.S.T.M. identical in respect of this temperature, either by us going down to 950°C. or the Americans coming up to 960°C. Even as it was, so far as actual results were concerned the two were more or less unified. The immediate effect of this would have been that those nations not already using 960°C. or thereabouts would have come into line sooner or later.

This new specification (No. 1016) officially reduces the temperature of the volatile matter test to 925°C., *and no plus or minus tolerance in temperature is mentioned.*

This reduction of temperature cannot be other than a major disaster to all who have long term records to keep, international contracts to devise, or international sales literature to prepare. The reduction in volatile matter will be of the order of one half of 1% at least. This may not seem very much at first glance until one thinks of those coals that lie at the lower end of each unit rise in the scale of volatile matter. Take, for instance, the gas coals lying at the lower end of the 32% class. These must now fall into the 31% class. The lower end of the 30% class will fall into the dreaded 29's. We shall say more of this later.

For all coals except the non-caking coals only one method remains. This is not a new method. It is a version of the American method and is to be carried out as follows:

A silica crucible with lid—the dimensions of both are given and we are referred to a drawing—shall be placed in a universal gas-mantle support (carefully specified) and heated in a pyrometer-controlled muffle furnace in the usual manner for exactly seven minutes. The tests can, of course, be carried out only one at a time, which is scarcely economical. Each test occupied seven minutes of furnace time, and therefore the hourly output cannot be better than eight tests. Since in all the best laboratories the test will be carried out in duplicate, this means the output will be four coals per hour, assuming, of course, that all goes well.

We can mention that it is more than ten years since this particular method was thoroughly tried out by us—*and scrapped.*

We are not absolutely certain that the silica crucibles used by us in this prolonged test were precisely the same as those now specified in B.S. No. 1016. Some of the dimensions of the crucible and lid are given, but the drawing of the crucible has been omitted from the specification.

As we have already mentioned, all the methods given in the original British Standard Specifications worked well, provided one standardized them against the American or crucible method. In addition to carrying out routine testing we are constantly occupied in research, and under this heading any proposed method of carrying out the various coal tests receives a fair test. We are looking for good things, since it pays us to find them. This applies with great force to the volatile matter, and from the work we have done on this topic one thing stands out crystal clear to us. This is, that the only technique capable of being set up from scratch, without the assistance of coals of known volatile matter to act as a guide, is the American method carried out in a platinum crucible at temperatures not less than 940°C. Small deviations from Standard cause least deviation of results. The crucible is so carefully specified that no trouble is ever experienced from this cause, provided that it is returned to the makers once in a while, there, for a few shillings, it will be made like new. The method is, however, tedious, and the crucibles are very costly if large numbers of them are needed. The other methods are more sensitive to variations in procedure, but are cheap to operate with large numbers of samples. The proper state of affairs, therefore, is the use of the American method to maintain control over any other techniques in use. To acquire a really good working knowledge of the operation and interpretation of the test, it is of importance to have spent at all events a little while in carrying out experiments, wherein the conditions are varied—particularly the temperature. But whoever set about installing the volatile test without encountering quite a number of its whims and vagaries?

The Fixed Carbon.—This is really the percentage of coke yielded in the volatile test, minus the amount of ash in it. In practice one usually adds together the moisture, ash, and volatile matter and deducts the sum from 100.

The Coke Button.—It would be very rash indeed to regard the proximate analysis as really complete until the buttons of coke produced in the volatile test have been examined. They will be found to vary enormously, but can be classified as follows:

(1) *Non-Coking Coals.*—The "coke" is black dust hardly different from the original coal. Examine with magnifying glass for coherence.

(2) *Coking but Non-Swelling Coals.*—The coke button is firm but dull and occupies no greater volume than the original coal.

(3) *Coking and Swelling Coals.*—The button is usually silvery and always of greater volume than the original coal.

Numerous sub-categories can be invented if it suits the fancy of the operator.

The cokes from category (3) coals vary greatly—from those which are completely coherent and only slightly swollen, to those which are blistered and swollen up to many times the original volume of the coal.

Daily contact with these coke buttons in all their variations can build up associations of appearance with the identity of the coal, especially when the buttons are fresh. There is a metallic silvery lustre about the fresh buttons from the best coking coals, and a dullness about the fresh buttons from the not-so-good coking coals that is almost unmistakable—*almost.* It is more than possible that regular association of coke buttons with actual coke produced will enable an individual to build up an experience that should enable him to spot the abnormal, but a very definite limitation must be set to the amount of "interpretation" that can be achieved by this means.

In our own laboratories proximate analyses are carried out in substantial numbers, and we therefore have ample opportunities of studying the methods and the results in the mass, and are compelled to resort to every possible device to minimize the number of personnel and energy consumption. A few notes on the methods employed may be of interest.

(1) *Securing Impartial Analyses.*—In an organization of this type our responsibilities to the coal trade cannot be taken lightly. A great many of the analyses act as a deciding factor in the price, or in claims for rebates. We have therefore always considered it to be of paramount importance that both our sampling and laboratory work should be as impartial and as accurate as possible. Thus we have always been convinced of the wisdom of keeping the laboratory staff in the dark about the identity of the coals, at least until the time when the results have been reported. To-day there are also many other reasons why this policy should be rigidly enforced. Our greatest worry is that bias should ever creep into the work. Now some coals run so uniformly that any departures from normal—especially in an adverse direction—come as a bit of a shock and have, of course, to be very carefully confirmed before we can put pen to paper and issue a report that is likely to have a serious consequence. Many years ago we ended any possibility of bias by reducing all our samples to the level of mere numbers before entering the laboratories. The numbers run in series and we have found it desirable to limit the serial numbers to four figures. Thus their coals are numbered in groups 1 to 9,999, each group receiving a further distinguishing symbol for record indexing. The coals are further subdivided into classes according to their origin, samples taken during the routine analytical control of plant being kept apart from samples representing consignments vended or purchased. All information regarding a coal is entered on special forms, leaving only the analytical results to add when the tests are complete. When all is over and the results sent off, these forms are stored in files where from time to time they are used for statistical purposes.

(2) *Checking Results.*—All analyses of important materials must be carried out in duplicate at least, and this leaves choice of two methods:

(1) The duplicate tests to be carried out by the same operator.

(2) Each of the duplicate tests to be carried out by independent operators.

The second method is, of course, our choice, but can only be carried out where large enough numbers of samples are involved to give continuous running. Thus each coal sample is prepared for laboratory examination in duplicate and the twin samples tested independently by different operators using duplicate equipment, which is a very desirable state of affairs when purely arbitrary tests, depending on the maintenance of standard conditions, are in use. Reasonable differences between operators are, of course, allowed, but if, as sometimes happens, these allowable differences are exceeded, the twin samples are exchanged-about between the operators and retested. This decides—

(1) Whether one or other operative or her equipment is in error.

(2) Whether the twin samples have been properly prepared so as to be identical.

From this the appropriate action can be taken, the results of possibility (2) being corrected by entirely re-preparing sample and re-testing. The results of the two independent samples are compared only by our Record Office. We take a poor view of any attempt to short-circuit this latter arrangement.

(*To be continued*)

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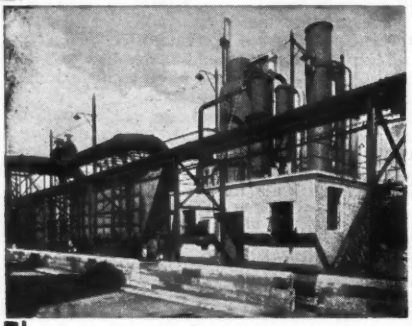

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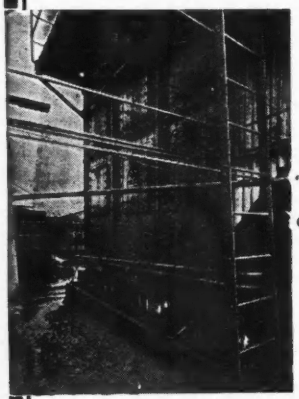

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Products Prices and Stocks and Shares

The London Market Feb. 22.

The chief item of interest in connexion with the Coal Tar Products market is the issue of a new Government Order, the Coal Tar Products Prices Order, 1942 (S. R. & O., 1942, No. 2509), which came into force on Jan. 1.

All Coal Tar Products are in good demand, and Pitch in the London area remains about 45s.

The Provinces Feb. 22.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 1s. 10d., pure, 2s. 5d. (controlled by the Control of Toluene No. 2 Order, July 3, 1941, which fixes the maximum price at which this material may be sold). Naphtha and Xylol controlled by the Coal Tar, Naphtha and Xylol Order, 1942, dated Dec. 7, 1942, and operative from Dec. 21. Carbolic acid, 60's, naphthalene, and anthracene controlled by the Coal Tar Products Prices Order S. R. & O. 2509, dated Dec. 7, 1942, and operative from Jan. 1, 1943. Filtered heavy oil (min. gr. 1,080), 7½d. to 8d. Creosote oil has been generally controlled as to direction and price for some time past. Current value—fuel grades 5d. to 5½d.; timber preservation and other purposes 4½d. to 6d.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Tar Products in Scotland Feb. 20.

Market continues active. Refined tar controlled. Value is 4½d. per gallon *ex* Works, naked. Creosote oil: Specification oil, 6½d. to 7d.; low gravity, 7½d. to 7¾d.; neutral oil, 6d. to 6½d.; hydrogenation oil, 5¾d. per gallon; all *ex* Works in bulk. Refined cresylic acid is available in small quantities at 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha: 6½d. to 7d. per gallon. Solvent naphtha: Basic prices delivered in bulk, 90/160 grade 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.; Rectified, 2s. 3d. per gallon. Pyridine: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

Markets on the whole were quiet and dull last week, with prices tending to move to lower levels. The Gas Section was an exception, and the recent resumption of dividend payments by two of the Metropolitan companies has firmed up prices all round. The result can be seen in the following list of upward movements, which contains more changes on a week than for a long time past. The only setback of note occurred in Commercial ordinary, which closed 6 points down on the "no-dividend" announcement.

The following price changes occurred during the week:

SUPPLEMENTARY LIST

Cambridge "B" (*x.d.*)	132—137	Feb. 15
Croydon 4 p.c. Pref.	85—90	+5
Hampton Court Ord. (*x.d.*)	95—100	Feb. 15
Plymouth & Stonehouse 5 p.c. Deb.	110—115	+3
Slough 5 p.c. Deb.	115—120	+5
Southampton 5 p.c. Red. Deb.	103—108	+8
Uxbridge 5 p.c. Deb.	120—125	+5

PROVINCIAL EXCHANGES

Chester Ord. (*x.d.*)	98—102	Feb. 1
Hartlepool Ord.	86—88	+2
Liverpool 5 p.c. Red. Pref. (assented)	100—104	+2
Newcastle Units (*x.d.*)	21/6—22/-	Feb. 8
Ditto 4 p.c. Pref. (*x.d.*)	93½—94½	"
Preston "A" (*x.d.*)	150—160	"
" "B" (*x.d.*)	109—119	"
Sheffield Ord.	130—133	+1
Weston-Super-Mare Ord. (*x.d.*)	95—100	Feb. 8

OFFICIAL LIST

Alliance & Dublin	95—105	—5
Associated Gas & Water Undertakings Ord.	19/—20/-	+1/6d.
Ditto 4½ p.c. Red. Cum. Pref.	19/—20/-	+2/-
Ditto 4 p.c. Red. Cum. Pref.	18/6—19/6	+1/-
Ditto 4 p.c. Cum. Pref.	16/—17/-	+1/3d.
Barnet Ord.	137—142	+2
Bournemouth max. Div. (*x.d.*)	135—140	Feb. 15
Ditto 4 p.c. Deb.	100—105	+3
Brighton Cons.	75—80	+1
Cardiff Ord.	102—107	+1
Commercial Ord.	56—61	—6
Ditto 5 p.c. Deb. (*x.d.*)	103—108	Feb. 15
East Surrey "B"	85—90	+2
Ditto 5 p.c. Deb.	120—125	+5
Gas Consolidation "B" Ord.	17/—18/-	+-/3d.
Gas Light & Coke Units (*x.d.*)	16/3—17/3	Feb. 15
Ditto 3½ p.c. max. (*x.d.*)	64—67	"
Ditto 4 p.c. Pref. (*x.d.*)	90—95	"
Ditto 3½ p.c. Red. Pref. (*x.d.*)	90—95	"
Ditto 3 p.c. Deb.	85—88	+1
Ditto 3½ p.c. Red. Deb.	94—97	+1
Mid-Southern Utility "C"	85—90	+2
Ditto 4 p.c. Pref.	85—90	+3
Plymouth & Stonehouse Ord.	70—75	+3
Primitiva Holdings Ord.	12/—14/-	—-/6d.
South-Eastern Gas Corporation Ord.	17/6—18/6	+-/9d.
South Metropolitan 6 p.c. Pref.	119—124	+9
Ditto 4 p.c. Pref.	90—95	+7
Ditto 3 p.c. Deb.	82—87	+1
South Suburban 4 p.c. Pref.	85—90	+2
Southampton Ord.	77—82	+4
United Kingdom Gas Corporation 4½ p.c. 2nd Non-Cum. Pref.	15/6—17/6	+-/6d.
Ditto 3½ p.c. Red. Deb.	95—100	+3
Wandsworth 4 p.c. Pref.	85—90	+2

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